ENGIN. LIBRARY
620.5
U58
J9

U. S. Department of Commerce • W. Averell Harriman, Secretary
National Bureau of Standards • E. U. Condon, Director

JOURNAL OF RESEARCH

of the

NATIONAL BUREAU OF STANDARDS

Volume 38—January to June 1947

Research Papers 1758 to 1806

Corrections to be noted in volume 38 of the Journal of Research of the National Bureau of Standards

Page	Line	Now reads in part	Should read
5	4th from bottom, col. 2	r-vectors	s-vectors
7	eq 46	$K_{mn}=K_{nm}\sum_i$	$K_{mn}=K_{nm}=\sum_i$
17	eq 86	E	E_{22}
53	22	Ethylcyclohexane (B)	Ethylcyclohexane
57	Table 2, col. 1	Ethylcyclopentane	Ethylcyclopentane (B)
134	Table 4, last col	23.08	23.80
		23.80	23.08
151	Table 7, line 5	KCl 1:29.28	HCl 1:29.28
151	Table 7, line 7	1/2 K_2SO_4 1:30	1/2 H_2SO_4 1:30
153	Figures 12, 14	Insert a period before each number on the q/i scale.	
156	Figure 15	The q/i scale numbers should be divided by 100.	
179	2	figure 5	figure 7
182	31, col. 1	II of RP1765 [2]	II
182	Figure 8	($R=2.7$, $l=\infty$)	($l=2.7$, $R=\infty$)
183	10	I of RP1765 [2]	II
187	Figure 3, legend	cathode	anode
189	6	$\times\frac{R_{l_2}-3.12}{R_{l_1}+1}$	$\times\frac{R_t-3.12}{R_t+1}$
189	23, col. 2	0.0115 to 0.0207	0.00115 to 0.00207
268	1	o η_0, f	of η_0
337	Figure 1	B×BaO	B=BaO
360	31, col. 1	adjustable baffle, B_3	adjustable baffle, B_2
361	Figure 2, legend	$T_6$15−6L6	T_6, 15 6L6's
401	Last, col. 1	$\pm\beta$	$-\beta$, $\pi-\beta$
406	eq 51	$2C_F\frac{fZ_L}{V}$	$2C_F\frac{vZ_L}{V}$
408	6 from bottom, col. 2	$A_\rho=0$ ..... $_\tau=0$	$A_\tau=0$ ..... $\rho=0$
409	eq 60	$n>1$	$n>\sqrt{2}$
409	eq 62	$-f$	$-f'(t)$
413	23	1.116 ± 0.02	1.116 ± 0.01
413	Figure 4, legend	0.883-Mev	0.88-Mev
		1.116-Mev	1.12-Mev
439	Table 1, last line	1.02 to .40	.02 to .40
445	Table 5, Sample No. 4		K_2O: A B C
			1.5 1.4 1.4
486	Figure 21, legend	B, material	B, severe, intercrystalline in material
598	13	Nichrome wire	Nichrome
648	2d from bottom	figures 2 and 5	figures 2 and 4,
649	11	of figure 6	of figure 5
651	Abstract, line 5	$+0^\circ$	0°
655	footnote 2	$(1-10^{-0.84823(T_c/T^2)}$	$(1-10^{-0.84823(T_c/T)^3}$
669	8	0 1r	0.1r

The Research Papers listed herein may be purchased from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at the prices indicated beginning on page IV, or at a discount of 25 percent for 100 copies or more. Remittance should be in the form of a post-office money order, coupons (issued by the Superintendent of Documents for the specific purpose of purchasing Government publications), express money order, New York draft, or cash at sender's risk. Postage is not required in the United States, to United States possessions, and to countries extending franking privileges. For mailing to other countries, an additional amount of about one-third of the purchase price is required. Remittances from foreign countries should be by international money order payable to the Superintendent of Documents, or by draft on an American bank. Prices of bound volumes are listed on page III, and for shipment to other countries requiring postage, add 50 cents to the cost of the volume.

RESEARCH PUBLICATIONS

of the

NATIONAL BUREAU OF STANDARDS

1904–1919:

(*a*) *Bulletin of the Bureau of Standards.* A quarterly journal. The *Bulletin* contained all research papers until, in 1910, it was limited to scientific papers; see (*f*) for technical papers.

(*b*) *Reprints* [1] from (*a*), *Scientific Papers* S1 to S329.

(*c*) Volumes [2] of (*a*), cloth-bound, consecutively paged and indexed. Volumes 1 to 14.

1919–1928:

(*d*) *Scientific Papers* [1] *of the Bureau of Standards* (separates continuing series (*b*), Nos. S330 to S572).

(*e*) Volumes [2] of (*d*), cloth-bound, consecutively paged and indexed. Volumes 15 to 22.

1910–1928:

(*f*) *Technologic Papers* [1] *of the Bureau of Standards,* T1 to T370. Prior to T203 issued only as separates.

(*g*) *Volumes* [3] of (*f*), cloth-bound, beginning with T203, volume designated No. 16 to volume 22; consecutively paged and indexed.

1928:

(*h*) *Bureau of Standards Journal of Research.* Monthly, continuing and consolidating (*d*) and (*f*).

1934:

(*i*) *Journal of Research of the National Bureau of Standards.* New title of (*h*), beginning with volume 13 (July 1934).

(*j*) Volumes [4] of (*h*) and (*i*), cloth-bound (six monthly issues), consecutively paged and indexed.

(*k*) Separates [1] of (*h*) and (*i*), issued under series title, *Research Papers.*

Circular C24 contains a list of (*a*) to (*g*), inclusive, from 1901 to June 30, 1925, accompanied by a short summary of each paper and a subject index. Three Supplements continue this list and, with the Circular, give a complete list of all publications to June 30, 1944. Copies of this Circular and the Supplements may be found at leading libraries having Bureau publications.

Copies of the separate or complete lists may be purchased from the Superintendent of Documents, Government Printing Office, Washington 25, D. C., as follows:

Circular C24, 7th edition (1901 to June 30, 1925)	$0.35
1925–1931 Supplement to C24 (July 1, 1925, to Dec. 31, 1931)	.25
1932–1941 Supplement to C24 (Jan. 1, 1932, to Dec. 31, 1941, with subject and author indexes, 1901 to 1941)	.50
1941–1944 Supplement to C24 (Jan. 1, 1942, to June 30, 1944)	.20
Complete list	1.30

[1] For prices and other information, see Circular C24 and Supplements thereto.

[2] Volumes 3 to 7, 10, 12 to 14, and 17, $2 each. Volumes 1, 2, 8, 9, and 11 of the Bulletin and volumes 15, 16, 18, 19, 20, 21, and 22 of the Scientific papers are out of print.

[3] Volumes 16 to 21, incl., $2 each; volume 22, $3.

[4] Volumes 3 to 6, $2.75 each; 7 to 37, $3 each. For shipments to foreign countries, add 50 cents to the cost of the volume.

765125—47

CONTENTS OF VOLUME 38

Vol. 38—January 1947—No. 1

RP		Page
1758	Vibrational frequencies of semirigid molecules: A general method and values for ethylbenzene. William J. Taylor and Kenneth S. Pitzer ---15 cents	1
1759	Analysis of a standard sample of natural gas by laboratories cooperating with the American Society for Testing Materials. Martin Shepherd ---20 cents	19
1760	Purification, purity, and freezing points of 8 nonanes, 11 alkylcyclopentanes, 6 alkylcyclohexanes, and 4 butylbenzenes of the API-Standard and API-NBS series. Anton J. Streiff, Evelyn T. Murphy, Janice C. Cahill, Helen F. Flanagan, Vincent A. Sedlak, Charles B. Willingham, and Frederick D. Rossini---20 cents	53
1761	Infrared absorption of some experimental glasses containing rare earth and other oxides. Ralph Stair and Conrad A. Faick---10 cents	95
1762	Properties of water-repellent fabrics. John W. Rowen and Domenick Gagliardi---10 cents	103
1763	Adsorption of water vapor by untanned hide and various leathers at 100° F. Joseph R. Kanagy---10 cents	119
1764	Concentration of the isotopes of mercury by free evaporation in a 10-cell counter-current reflux still. A. Keith Brewer and Samuel L. Madorsky ---10 cents	129

Vol. 38—February 1947—No. 2

1765	Concentration of isotopes of potassium by the counter-current electromigration method. A. Keith Brewer, Samuel L. Madorsky, John Keenan Taylor, Vernon H. Dibeler, Paul Bradt, O. Lee Parham, Roy J. Britten, and J. Gilman Reid, Jr---15 cents	137
1766	Concentration of potassium ^{39} by countercurrent electromigration: Some theoretical aspects of the operation. James W. Westhaver---10 cents	169
1767	Concentration of isotopes of chlorine by the countercurrent electromigration method. Samuel L. Madorsky and Sidney Straus---10 cents	185
1768	Normal coordinate analysis of the vibrational frequencies of ethylene, prophylene, *cis*-2-butene, *trans*-2-butene, and isobutene. John E. Kilpatrick and Kenneth S. Pitzer---15 cents	191
1769	Infrared absorption spectra of seven cyclopentanes and five cyclohexanes. Earl K. Plyler, Ralph Stair, and Curtis J. Humphreys---15 cents	211
1770	Elastic behavior and creep of refractory bricks under tensile and compressive loads. Lewis E. Mong---10 cents	229
1771	Surface tensions of some optical glasses. Leo Shartsis and Alden W. Smock---10 cents	241
1772	Laminar boundary-layer oscillations and transition on a flat plate. Galen B. Schubauer and Harold K. Skramstad---20 cents	251

Vol. 38—March 1947—No. 3

			Page
1773	Ceramic coatings for high-temperature protection of steel. William N. Harrison, Dwight G. Moore, and Joseph C. Richmond	10 cents	293
1774	Electrical characteristics of quartz-crystal units and their measurement. William D. George, Myron C. Selby, and Reuben Scolnik	15 cents	309
1775	Ionization and dissociation of *cis*- and *trans*-2-butene by electron impact. Vernon H. Dibeler	10 cents	329
1776	Properties of barium-strontium titanate dielectrics. Elmer N. Bunting, George R. She'ton, and Ansel S. Creamer	10 cents	337
1777	Determination of small amounts of carbon monoxide in air by various reference methods. Martin Shepherd	10 cents	351
1778	A magnetic-lens electron spectrometer: Radiations from 5.3 year cobalt.[60] Leonard C. Miller and Leon F. Curtiss	10 cents	359
1779	Preparation and physical properties of several aliphatic hydrocarbons and intermediates. Frank L. Howard, Thomas W. Mears, A. Fookson, Philip Pomerantz, and Donald B. Brooks	15 cents	365

Vol. 38—April 1947—No. 4

1780	Synchronization of oscillators. Robert D. Huntoon and Albert Weiss	10 cents	397
1781	Disintegration of scandium.[45] Irving Feister and Leon F. Curtiss	10 cents	411
1782	High-temperature X-ray diffraction apparatus. Alvin Van Valkenburg, Jr., and Howard F. McMurdie	10 cents	415
1783	Heats of combustion and isomerization of six nonanes. Walter H. Johnson, Edward J. Prosen, and Frederick D. Rossini	10 cents	419
1784	Structure of difructose anhydride II. Emma J. McDonald and Anne L. Turcotte	10 cents	423
1785	Mangabeira latex and rubber. Norman Bekkedahl and Waldemar Saffioti	10 cents	427
1786	Spectographic determination of minor elements in portland cement. Armin W. Helz and Bourdon F. Scribner	10 cents	439

Vol. 38—May 1947—No. 5

1787	Electrical methods for diamond-die production. Chauncey G. Peters, Walter B. Emerson, Karl F. Nefflen, Forest K. Harris, and Irvin L. Cooter	10 cents	449
1788	Effect of artificial aging on tensile properties and resistance to corrosion of the 24S–T aluminum alloy. Hugh L. Logan, Harold Hessing, and Harold E. Francis	15 cents	465
1789	Cooperative analysis of a standard sample of natural gas with the mass spectrometer. Martin Shepherd	10 cents	491
1790	Infrared emission spectra of krypton and argon. Curtis J. Humphreys and Earle K. Plyler	10 cents	499
1791	Dipole moments and resonance of some benzein indicators and related compounds. Arthur A. Maryott and S. F. Acree	10 cents	505
1792	An improved Geiger-counter arrangement for determination of radium content. Francis J. Davis	10 cents	513
1793	Changes caused in the refractivity and density of glass by annealing. Arthur Q. Tool, Leroy W. Tilton, and James B. Saunders	10 cents	519
1794	Conductimetric titrations of acids and bases in benzene and dioxane. Arthur A. Maryott	10 cents	527
1795	Analyses of alkylates and hydrocodimers. Augustus R. Glasgow, Jr., Anton J. Streiff, Charles B. Willingham, and Frederick D. Rossini	25 cents	537

Vol. 38—June 1947—No. 6

			Page
1796	An improved ice calorimeter—the determination of its calibration factor and the density of ice at 0° C. Defoe C. Ginnings and Robert J. Corruccini	10 cents	583
1797	Enthalpy, specific heat, and entropy of aluminum oxide from 0° to 900° C. Defoe C. Ginnings and Robert J. Corruccini	10 cents	593
1798	Transmission measurements with the Beckman quartz spectrophotometer. Kasson S. Gibson and Margaret M. Balcom	10 cents	601
1799	Mass spectrometer study of the rare gases. Vernon H. Dibeler, Fred L. Mohler, and Robert M. Reese	5 cents	617
1800	Hydrocarbons in the 102° to 103° C fraction of petroleum. Augustus R. Glasgow, Jr., Charles B. Willingham, and Frederick D. Rossini	10 cents	621
1801	Heats of combustion and solution of liquid styrene and solid polystyrene, and the heat of polymerization of styrene. Donald E. Roberts, William W. Walton, and Ralph S. Jessup	10 cents	627
1802	Torsion of a rubber cylinder. Ronald S. Rivlin	10 cents	637
1803	Compensation of the aperture ratio markings of a photographic lens for absorption, reflection, and vignetting losses. Irvine C. Gardner	10 cents	643
1804	Heat capacities of gaseous oxygen, isobutane, and 1-butene from −30° to +90° C. Paul F. Wacker, Ruth K. Cheney, and Russell B. Scott	10 cents	651
1805	Heats of solution of solid solutions of hexacalcium dialumino ferrite and dicalcium ferrite. Edwin S. Newman	5 cents	661
1806	Relative thickness of lead, concrete, and steel required for protection against narrow beams of X-rays. George Singer, Harold O. Wyckoff, and Frank H. Day	10 cents	665
	Index to volume 38 (January to June 1947, Research Papers RP1758 to RP1806)		673

U. S. GOVERNMENT PRINTING OFFICE: 1947